

12

Gebrauchsmuster

U1

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Schutzrohrsegment für die Zusammensetzung eines
Schutzrohrabschnitts für elektrische Leitungskabel
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Cable protecting tube segment for the assembly of a protecting tube section for electrically conducting cables

At the underground laying of electrically conducting cables there are frequently used protecting tubes from a plastic material, which tubes are assembled from individual tube pieces and are intended for protecting a cable for example against the influence of stones that are pressed against the cable sheath during the filling of the cable trench and during the subsequent compaction of the fill. These protecting tubes which consist for example of 600 cm long tube pieces and which are often provided on one side thereof with a pipe joint engaging over the end of the following or the preceding tube frequently fail to provide full protection when a cable has to be laid underground. In such a case the cable section which is laid in an arc shape either remains unprotected or there are gaps produced between the slipped-on tube pieces, which gaps leave the cable sheath exposed and unprotected. Although continuous protection is obtained by using tube sections that are flexible due to their corrugated wall, it turned out as difficult in the practice to push a cable through such a corrugated tube piece. A further drawback is seen in the fact that corrugated tubes may also be bent to an extent allowing relatively small laying radii, so that there is a tendency to lay cables at radii which are smaller than those beneficial to a cable, although the smallest admissible radius depends on the cable thickness. To remove these drawbacks there is known from the document DE-DM G 90 11 031 a protecting

tube or protecting tube section which is designed for being laid in an arc-shaped fashion and which is assembled from protecting tube segments that are movable one relative to the other in the form of a ball joint. The protecting tube segments are outstanding by the fact that they are provided on one end with a toric wall enlargement and on the other end with a bell mouth, of which the inner contour is adapted to the outer contour of said toric enlargement and which surrounds said toric enlargement up to and beyond the largest center plane when the segments are assembled. In addition, the clear width of the opening of the bell mouth portion is dimensioned in such a way that upon reaching a predetermined minimum radius R_{\min} (of e.g. 500 mm for a 45 mm thick cable) the inner edge of one segment will apply against the outer wall of the following segment, thereby preventing any further twisting of the section beyond the minimum radius that is predetermined for the respective segment size.

However, in practice it has shown that in a section which is assembled from several segments a segment may slip off the segment that is supported by said segment if a correspondingly high force is applied in the attempt of bending said section into a radius which is smaller than the admissible radius. In such a case one may succeed in bending said one side of the enlargement, which is the inner curvature side, against the wall of the following segment, possibly under a deformation of the same, to an extent that the opposite side of the enlargement, which is the side that is more remote from the curvature, will lift off over the end of the enlargement of the supported segment and thus tear apart the whole section.

The invention is therefore based on the problem of improving known segments for the assembly of flexible sections for the laying of conducting cables in such a way that the bending radius cannot be less than a predetermined smallest bending radius of the section assembled from such segments, even at a high expenditure of forces. The invention solves this problems by the means defined

in the claims. One embodiment of the invention will be described in the following by way of an example and with reference to the attached drawings.

In the drawings it is shown by:

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| Figure 1 | a segment for the production of a protecting tube section according to the invention, in a vertical section; |
| Figure 2 | the segment according to figure 1 in a side elevation, viewed in the direction of arrow II in figure 1; |
| Figures 3 and 4 | a modified form of execution of the segments shown in figure 1; |
| Figure 5 | a tube section assembled from segments according to the figures 1 and 2 and a straight center line; |
| Figure 6 | a tube section assembled from segments in an arcuate fashion. |

In the figures 1 and 2 reference number 1 generally designates a substantially tubular segment which includes in a manner known per se a toric enlargement 2 of the wall 3 on one – upper – end and a bell mouth enlargement 4 on the opposite – lower – end. This enlargement 4 is dimensioned so that according to the figures 5 and 6 said toric enlargement 2 fits with a small tolerance in the space 5 of said enlargement 4 or in other words said enlargement 4 surrounds a toric enlargement of a following segment. The bell mouth enlargement portion 4 is formed in such a manner that with a straight center line the end portion 7 reaches beyond the center plane 8 of the enlargement 2 of the following segment. In addition, the clear width 9 of the opening of the bell mouth portion 4 is

dimensioned so that upon reaching a minimum radius R_{\min} the most expediently chamfered inner edge 10 of one segment will apply against the outer wall of the following segment. However, to prevent that even with the exertion of strong forces a tube section assembled from segments is bent to such an extent that the segments will separate from each other, each segment 1 is, according to the invention, provided with a flange 11 that lies in the transition between the toric enlargement 2 and the cylindrical wall portion 3.

If in a tube section that is assembled from several segments 1a, 1b, ... to form a curved tube section the smallest admissible curvature radius R_{\min} is reached, the final edge portion 10' of segment 1c positioned on the inner side of the curvature will, according to figure 6 and as explained by way of the segments 1b and 1c, rest on or be supported by the flange 11' of segment 1b on this place, whereby any further bending or reduction of R_{\min} is at least made extremely difficult.

This effect may be increased if the specific pressing between the flange of said one segment and the supported edge portion of the other segment is reduced, and to this end each segment may have opposite cams 12 on the same diameter rising from the flange, of which the height is, according to figure 6, dimensioned so that e.g. the inner edge 10" of segment 1d will be additionally supported by cam 12 when the smallest admissible bending radius is reached.

As it can be also seen from figure 1, upon reaching R_{\min} the upper edge 13 of one segment, e.g. segment 1c, will enclose together with the lower edge 10" of segment 1d a definite angle. The smallest surface pressure between the lower edge 10" and the flange 11" would be obtained if its upper effective surface were designed so as to first increase in an inclining fashion following line 14 and then decline again (for a curvature in the opposite direction), and this is why according to a further feature of the invention the flange may be formed in a corresponding manner, which is shown in figure 2 by the dot-dash line 15.

However, while the manner in which the segments are assembled to form a section is unimportant for segments that are merely provided with a flange 11, sections assembled from segments that are provided with additional cams 12 or with an inclining and declining surface 15 require that during assembling all segments are mutually positioned in a manner such as shown in figure 6, which means that upon reaching the smallest admissible curvature radius the lower edges 10 of said one elements rest with the inner side of the curvature on the flanges of said other elements and rest on the cams 12 in a fashion offset by 90° towards both sides.

This is obtained by forming slots 16 in the bell mouth portion 4, which slots may be engaged by short pins 17 at a corresponding location of the toric enlargement, thereby attaining not only the correct mutual position of the segments with regard to their support on the flanges but also an additionally increased stability of the ball-joint connection and making it more difficult to unintentionally separate the segments from each other during the attempt of reaching a curvature smaller than admissible by exerting considerable forces. The segments 1a and 1b in figure 6 show for example that not only the lower edge 10'' is supported by the inner curvature side on the flange 11'', but that at the same time on the outer curvature side the portion 18 of the bell mouth portion 4 which has stopped under the slot 16' grips/engages under the associated pin 17', whereby any curvature larger than R_{\min} is additionally made more difficult.

The assembly of several segments into a tube section is made easier if, according to figure 2, the pins 17 for fitting the bell mouth portion of another segment are rounded on the upper side thereof.

The figures 3 and 4 represent connection segments 19 and 20, respectively, which segments are different from the segments according to the figures 1 and 2 by inner flanges that divide the inner space. In the segment according to figure 3 the flange is positioned in the upper enlargement portion 2 and in the

connection segment 20 according to figure 4 the flange 22 is positioned in the lower region approximately at the transition from the cylindrical portion 3 to the bell mouth portion 4. As it can be seen from figure 6, these connection segments serve for plug-fitting straight tube protecting pieces 23.

Claims

1. Protecting tube segment for the production of protecting tubes or protecting tube sections for electrical cables laid in an arc fashion, which protecting tube segment is provided on one end with a toric wall enlargement (2) and on the opposite end with a bell mouth (4), of which the inner contour is adapted to the outer contour of said toric enlargement (2) and which surrounds said toric enlargement when the segments are in the assembled state,
c h a r a c t e r i z e d in that at the transition from the toric enlargement (2) to a cylindrical portion (3) a supporting surface is provided against which the lower edge (10) of a slipped-on further segment is supported upon reaching an admissible smallest curvature radius (R_{min}) of an arc composed of segments.
2. Segment according to claim 1,
c h a r a c t e r i z e d in that said supporting surface is a continuous or discontinuous flange (12).
3. Segment according to claim 2,
c h a r a c t e r i z e d in that at least one cam (12) rises from said flange (11), the height of which is dimensioned so that the lower edge (10) of a slipped-on segment is supported thereon upon reaching an admissible smallest curvature radius of an arc that is composed of segments when this lower edge (10), offset by 90° with respect to said cam, is directly supported on said flange (11).
4. Segment according to claim 3,
c h a r a c t e r i z e d by two cams (12) opposing each other on one diameter.

5. Segment according to the claims 2 to 4,
c h a r a c t e r i z e d in that the upper surface of the flange (11) increases from the smallest thickness to the height of a cam (12) over an arc of 180° and thereafter decreases again to the smallest thickness.
6. Segment according to claim 1,
c h a r a c t e r i z e d in that in addition to said supporting surface locking elements are provided, of which the one that is provided on one segment cooperates with a second one that is provided on the other segment.
7. Segment according to claim 6,
c h a r a c t e r i z e d in that said locking elements consist of slots (16) in the bell mouth portion (4) and pins (17) on the toric enlargement (2).
8. Segment according to claim 7,
c h a r a c t e r i z e d in that said slots (16) and pins (17) are offset by 90° with respect to said cams (12) or the highest elevation of a flange with an increasing and decreasing surface (15).